Patent claims:

1. A device for the thermal decomposition of volatile compounds and deposition of particles which are then formed, which includes at least the following characteristic features
   - a pressure vessel (1),
   - at least one reaction tube (2), the open end (2c) of which extends into the pressure vessel and the other end of which is located outside the pressure vessel and is provided with a gas feed (3), the longitudinal axis of the reaction tube is oriented in the direction of gravity and parallel to the longitudinal axis of the pressure vessel (1d), and the reaction tube can be heated (2a) on the gas inlet side and cooled (2b) on the gas outlet side,
   - the pressure vessel (1), in its lower part, has a collection cone (1a), the open end of the reaction tube(s) (2c) extending into the gas space of the collection cone (1b),
   - the collection cone (1a) is connected to an outlet lock (6) for particles (P), and
   - a gas outlet unit (7), which is equipped with a gas guide (7a), the gas inlet region (7b) of which is in communication with the gas space (1b) of the collection cone (1a), a filter system (8) and a gas outlet (9), which is located outside the pressure vessel.

2. The device as claimed in claim 1,
   wherein the outer walls of the pressure vessel (1) are coolable (1c).

3. The device as claimed in claim 1 or 2,
   wherein a reaction tube (2) has a length of from 60 to 700 cm.

4. The device as claimed in any of claims 1 to 3,
   wherein a reaction tube (2) has a diameter of from 30 to 400 mm.

5. The device as claimed in any of claims 1 to 4, wherein a reaction tube (2) consists of metal, silicon nitride, silicon carbide, Si-infiltrated silicon carbide or quartz glass.

6. The device as claimed in any of claims 1 to 5, wherein a reaction tube (2) is sheathed by an electrical resistance heating means (4) on the gas inlet side.

7. The device as claimed in any of claims 1 to 6, wherein a reaction tube (2) is surrounded (2b) by a cooling unit (5) toward its open side (2c).

8. The device as claimed in any of claims 1 to 7, wherein a reaction tube (2) can be heated over 30 to 70% of its length.

9. The device as claimed in any of claims 1 to 8, which includes 2 to 36 reaction tubes (2).

10. The device as claimed in any of claims 1 to 9, which includes an outlet lock (6) with a double-flap system (6a, 6b).

11. The device as claimed in any of claims 1 to 10, which includes a filter system (8) having one or more filter candles.

12. The device as claimed in claim 11, which includes filter candles made from sintered metal, ceramic, fibers or plastic.

13. The device as claimed in one of claims 1 to 12, wherein reaction tubes (2) and the gas outlet unit (7) are connected to the pressure vessel (1) by means of water-cooled steel flanges.

14. A process for the thermal decomposition of at least one volatile compound and deposition of particles which are then formed, using the device as claimed in any of claims 1 to 13, in which

- the corresponding reaction tubes (2) are heated on the inlet side (2a) to the decomposition temperature of the volatile compound, and the lower region (2b) of the reaction tubes is cooled,
- the volatile, thermally decomposable compound is if appropriate diluted with a substantially inert gas and this gas or gas mixture (G) is fed to the reaction tubes (2) via the corresponding gas feed (3),
- the particles (P) which are formed during the decomposition and have gathered in the collection cone (1a) are discharged via the lock unit (6), and
- the gas or gas mixture (G') which is formed during the decomposition reaction is discharged via the gas outlet (9), with the pressure in the pressure vessel (1) being kept substantially constant.

15. The process as claimed in claim 14,
wherein the inlet-side part of the reaction tubes (2a) is heated to a temperature which is above the decomposition temperature of the substrate, in the case of SiH_4 from 800 to 1100°C.

16. The process as claimed in claim 14 or 15,
wherein the lower part of the reaction tubes (2b, 2c) is cooled to a temperature of ≤ 100°C.

17. The process as claimed in any of claims 14 to 16,
wherein monosilane, undiluted (G) or diluted with hydrogen (G), is fed to the pyrolysis reactor.

18. The process as claimed in claim 17,
wherein high-purity silicon powder (P) is obtained, with the product (P) being

discharged from the collection cone (5) in batches via a double-flap system (6a, 6b) of the outlet lock (6).